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EDITORIAL DEPARTMENT NOTE

In this issue of our Bulletin we are presenting two excellent papers. The first one not only describes an accounting system for a motion picture producer, but also gives a brief chronological description of the various activities performed in making a motion picture. The main feature of the accounting system herein described seems to be the extent to which it is broken down to cover the many departments involved.

Mr. Oscar Gilbertson, the author of this paper, is a certified public accountant of the States of Washington and California. While he was employed for two years with Price-Waterhouse & Company, Accountants and Auditors, he prepared audits for several motion picture studios. For the past three years he has been employed by Warner Bros. Theatres as auditor of their Pacific Coast Division. Mr. Gilbertson delivered this paper at the May, 1932, meeting of the Los Angeles Chapter.

The second paper is one which should be of particular interest to many of our members in the metal industries. It treats of an accounting system for a metal mine and is specific in its application. Several of the more important questions and problems of mine accounting are treated in a very excellent manner.

Mr. Jesse L. Maury, the author of this paper, attended the Montana State School of Mines and the University of Chicago, and received a Bachelor of Science Degree in Mining Engineering from the Massachusetts Institute of Technology in 1925. This paper was prepared by Mr. Maury as a partial fulfillment of the requirements for the degree of Master of Business Administration of the Massachusetts Institute of Technology and is a record of extensive observations and experience in the field as well as a considerable amount of theoretical and technical study. Mr. Maury's experience covers a wide variety of activities from those of a chainman on a surveying crew of the U. S. General Land Office in the summer of 1918 to those of Assistant Manager, then Manager of the Broadwater Consolidated Mines, Neihart, Montana, from 1928 to 1931. He is a member of Mining Society, Massachusetts Institute of Technology, Associate Member, American Institute of Mining Engineers, and is the author and co-author of several publications on mines and mining operations.

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October 15, 1932

COST ACCOUNTING FOR MOTION PICTURE PRODUCTION

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BEFORE considering the cost accounts in motion picture production it might be well to give a brief synopsis or chronological order in which a picture is generally produced.

A synopsis of a story is made by the scenario department and is reviewed by studio executives.

A story is purchased or written by the scenario department. If purchased it is submitted to a writer who adapts it to the screen, by condensing or otherwise changing such dialogue or action as is necessary.

A chronological arrangement is made of the dialogue and action into sequences, sets, and scenes.

A production supervisor and director are assigned to the picture. They cooperate with the scenario department in the preparation of the final continuity. A multigraphed or mimeographed copy is made from the continuity, each section being a complete sequence. This is called a script.

The studio executives, production supervisor, director and casting director make the selection of the cast.

The assistant director then makes a breakdown of the continuity and an analysis sheet is prepared for each set as follows: picture number or tentative title; number and name of set; total number of scenes; scene number and a short resumé of the action of each scene; description necessary for guidance in the construction of the set; description of props for dressing the set; wardrobe, showing style, etc.; type of people for cast and style of wardrobe; special effects required; and music, songs, and other miscellaneous requirements.

The production department is furnished with the above information and prepares a chart. The names of the cast are listed down the left-hand side and the name and number of each set across the top. A cross is placed opposite each name under the particular set in which the actor will appear.

Another chart is then made in "shooting" order. This however, is not the same order as the finished story. If a high-salaried actor is engaged on a weekly basis and is supported by a number of extras who appear in, say only three or four sets, in scattered parts of the picture, these sets are taken as a group to minimize the cost of services of actors and eliminate idle time. This schedule also gives the estimated number of days required for the photographing of each set or scene.

Each of the various departments is furnished with the necessary data relating to the department for the purpose of arriving at an estimated cost, that is, cost of each set from the construction department, cost of ward-robe from wardrobe department, etc.

From the estimated costs furnished by the various departments, a budget is compiled. After the budget is approved, and if it is within the limit of the amount authorized and approved by the local studio executives, each department is then authorized to proceed with the work.

The art director designs the sets, and plans or blue prints are drawn by architect and draftsmen. When approved by the supervisor and director, they are submitted to the construction department. Sets are constructed in "shooting" order as shown in the chart previously mentioned.

Miniature sets, trick or process shots are made and produced by the scientific research department.

The wardrobe designer creates the style and models required for the cast.

The drapery department makes the necessary draperies as required on sets.

All musical numbers or songs used in the picture are composed by the music department, or if copyrighted songs are used, or any part of them, the picture rights must be purchased.

A few days before rehearsals, the sets are dressed by the interior decorator who supervises the hanging of drapes, placing of the furniture, props, etc.

The chief electrician is responsible for the proper lighting of sets.

The chief sound technician places the microphones in the required positions to obtain the best results in recording.

A call sheet is issued requesting the necessary operating units, and cast, to report for duty.

Several cameras are used on each set, taking the picture at different angles.

The booth for the recording equipment is enclosed and is built overlooking the set. It is equipped with a glass front so that the operators may see the entire action. An instrument called the "mixer" is used which blends the sound. The sound is usually recorded on sound tract film and wax plates. The purpose of the wax records is that the director and technicians may test the voices or sound by immediately playing back the record through the reproducing equipments. Sound is usually recorded simultaneously on several wax records. All film taken during the day is developed and projected the following day for the approval of studio executives, director and chief cameraman. The films projected each day are called "Dailies."

When the picture has been photographed, the film is then cut and spliced and arranged in the order of the original story. The work done in the cutting room is of great importance, as it is in this department that many flaws are corrected. Action can be speeded by shortening the film, and the proper length given to titles, and the various sequences.

The first print completed in the cutting room is then projected for the final approval of studio executives. This print is also used to preview the picture in a theatre to get the reaction of the audience. Script girls are seated in various places in the theatre to write down remarks heard. The film is then returned to the cutting room to eliminate the most undesirable shots, or shorten certain sequences which seem too long or "drawn out" to the audience.

From the final approved print, the negative is made. All prints for distribution to exhibitors are then made from the final negative.

Each picture is a separate and distinct product. The conditions under which it is made and the cost of a picture has no bearing or relation to the cost of any other.

Before proceeding with the discussion of accounts or accounting set-up for motion picture production, an explanation of some technical terms will be given.

A "Scenario" is referred to as a complete story adapted for motion pictures.

A "Treatment" of a story, or a "Continuity" is the adaptation or the changing of a story from its original form to a more comprehensible or detailed story by condensing or revising such action and dialogue as is necessary to adapt it for pictures.

A "Script" is a breakdown of a story into sequences, sets, etc., and is arranged in "shooting" form.

"Sets" are known as all interiors and exteriors built especially for the production of a picture.

"Props" are those articles that are used to dress the sets, such as furniture, wall hangings, statues; and for outside sets, such as automobiles, airplanes, animals, boats, etc.

"Shooting Days" are the actual days that the "shooting" of the picture takes place, or the days that the cameras are in actual operation.

General Outline by Departments

Story, or Scenario Dept.:

This department originates stories and ideas, purchases picture rights of stories written by others and prepares the story for production.

Production Dept.:

Casting Dept.: Selection of Cast.

Research Dept.: For selection of proper sets, wardrobe, location, etc., to create correct setting for a particular picture.

Wardrobe Dept.: Costumes, etc.

Character-Wardrobe Dept.: Character make-up, wigs.

Drafting Dept.: Drawing plans for sets.

Construction Dept.: Building of sets.

Electrical Dept.: In charge of lighting effects.

Drapery Dept.: Making and hanging of drapes in sets.

Prop Dept.: Selecting, furnishing and placing of furniture, accessories, etc.

Mechanical Dept.: Includes foundry, blacksmith shop and machine shop, manufacturing special metal units for sets.

Music Dept.: Creation of, or adaptation of music, songs, etc., used in recording of pictures.

Camera Dept.: In charge of taking motion pictures.

Still Dept.: Taking stills or snapshots when motion picture cameras are in action. All stills are 8 x 10 inches and used in advertising or exploiting the picture.

Miniature Set Dept.: The making of and photographing miniature sets or objects, when developed on film give the appearance of being life-size.

Trick-Shot Dept.: Taking trick shots or unusual effects or angles. Also Glass Shots.

Recording Dept.: In charge of operation of all recording and sound equipment.

Laboratory Dept.: Developing of film.

Title Dept.: Making titles for pictures, listing the names of cast, etc.

Cutting Dept.: Arranging the negative in proper sequence according to the finished story.

Projection Dept.: The projection or showing of the film taken during the previous day and the finished product for final approval of studio executives.

Other Miscellaneous Departments:

Administration Dept., Accounting Dept., Purchasing Dept., Transportation Dept., Engineering Dept., Art Dept., Publicity Dept., Fan Mail Dept., Legal Dept., Medical Dept., Insurance Dept., Timekeeping and Payroll Dept., and the Stenographic Dept.

Production Accounts and Costs

General:

The extent of the departmentalization of a studio largely determines the classification of production accounts.

The expenditures of the various departments that can be directly allocated to a particular picture are charged as

direct costs to that picture. All indirect costs are charged to studio overhead and absorbed in pictures on a pro-rata basis.

Overhead:

The basis of absorbing studio overhead in pictures varies considerably in different studios.

(1) It may be distributed to picture costs on a "shooting" day basis; that is, a flat charge per day for each day that the cameras are in actual operation.

(2) It may be distributed on the basis that the direct estimated cost of the picture bears to total production cost for the year.

(3) Actual overhead for the week may be distributed equally to the productions in process during that week.

(4) Total overhead for the year may be distributed equally to pictures completed within the year.

The second basis is most commonly used in studios, and seems to be the most equitable. If the direct cost of a picture is estimated at One Hundred Thousand Dollars and another at Five Hundred Thousand Dollars, it seems logical that the One-Half-Million-Dollar picture be charged with five times as much overhead as the one costing One Hundred Thousand Dollars. The first picture may take two to four weeks in production while the second one may take from eight to ten weeks which would also substantiate the ratio of overhead charged to each picture.

The most frequent items appearing in overhead are:

Salaries and expenses of executives.

Sustaining salaries and expenses of general operating and non-operating departments.

Retaining time of studio directors, supervisors and actors.

Plant expense, depreciation and maintenance, power, light, heat, etc.

All other general expense, such as insurance, legal fees, telephone and telegraph, taxes, licenses and charged-off scenarios, shelved pictures, etc.

Miscellaneous income, such as salvage of materials, income from by-products, etc.

Direct Costs:

Sub-accounts giving more detailed cost of pictures may be classified in general as follows:

Scenario or Story Dept.: Salary of writers, proof readers, stenographers, supplies and incidental expenses.

Cost of stories purchased, including screen rights, copyrights of titles, etc.

Casting Dept.: Salaries of stars and extras. Salaries and expenses of personnel of this department.

Wardrobe: All cost and upkeep of department while engaged in making costumes for a picture. Ordinary costs are, salaries of designers, dressmakers and cost of materials, patterns, etc. If stock costumes are used, a nominal rental is charged.

Sets: All costs in connection with the drafting of plans and the construction of sets, such as salaries of carpenters, painters, foundry men, electricians; cost of dressing the sets, such as props, drapery, etc.; cost of lighting the sets such as salary of electricians and rental of lamps (if not owned). This also includes cost of art department for salaries and supplies of sculptors in making clay statues or ornamental work for props.

Location Dept.: All salaries and expenses of personnel, cost of transportation to and from studio, that is, transportation of cast, sets, props, lighting equipment, and incidental expenses such as miscellaneous purchases, gasoline, oil, etc.

Camera Dept.: Salaries of cameramen, assistant cameramen, still cameramen. Cost of negative film, upkeep of cameras.

Laboratory Dept.: Developing of film. This cost also includes not only the cost of developing negative film, but also the cost of raw stock and developing of original negative, studio print, preview print, censorship print and one studio negative for permanent record. All other negatives and prints made are charged to the distribution department. The laboratory cost is usually charged at an established cost per foot of film developed. Cost of negative raw stock is about .04 per

foot and positive raw stock .01 per foot. Average cost of developing film is approximately .018 per foot.

Cutting Dept.: All salary and incidental costs of this department while working on a picture. This department cuts or gathers the film in the proper sequences according to the finished story.

Music Dept.: Salary and expenses of musical director and musicians in the recording of the picture. Also royalties and music rights if copyrighted songs are used. If theme songs are written or composed at the studio, the cost would also include the salaries and expenses of the composers.

Recording Dept.: Salaries of technicians, and expense of this department such as cost of waxes and records and also line charge for remote control if set is situated outside of studio plant.

Trick Shot and Miniature Dept.: Cost of experiments in producing certain unusual effects or trick shots. Cost of manufacturing miniatures, also the photographing of same.

General Records:

Payroll and Timekeeping Records: All departments taking part in the production of a picture, the cost of which would be direct cost to the particular picture, are furnished with payroll records which give the number of the picture, number of the set, the name of the department doing the work, and the number of hours worked that day on a picture. These itemized records are OK'd by the respective department heads and forwarded to the central timekeeping office where these slips are sorted and costs accumulated under captions already enumerated. The timekeeping department computes the actual salary for each individual, which is then forwarded to the accounting department.

Requisitions: All operating department heads are furnished with requisitions on which they enumerate the materials, props, wardrobe, draperies, etc., which are to be furnished by the various stores that have stock materials. These requisitions are made out in detail, giving information as to the number of the picture, the number of the set, and the sub-

account number to which it is to be charged. The requisition is then OK'd by the department head and forwarded to the department which is to furnish the goods.

If the goods requisitioned is lumber, paints and materials for the construction of a set, the storekeeper places on the requisition the cost of these articles and it is then forwarded to the accounting department.

If the requisition is for stock costumes, props, etc., the heads of those departments place on the requisition the established rental per day. These are then forwarded to the accounting department where these requisitions are sorted and charged to the respective sub-accounts shown thereon.

In case of rental from various stores in the studio the rental is charged to the picture and the income is credited to general overhead.

Purchase Orders: The purchasing department is charged with the purchase of any and all materials, props, etc., which are to be used in pictures or for the maintenance of the plant.

The various operating departments make requisitions which are OK'd by the production manager and forwarded to the purchasing department where the order is actually placed.

When the invoices are rendered by the respective vendors the purchasing department checks the account number and distribution, which information they obtain from the requisition. The invoices, after the account numbers have been placed thereon, are forwarded to the production manager for O.K. and then delivered to the accounting department for entry. To the invoices are usually attached a copy of the requisition and the delivery slip, indicating that the goods have actually been received.

When a prop is purchased for a particular picture the entire cost is charged to that picture. After it is no longer required for that picture the prop is then put in stock in the prop department at a nominal value which is credited to the picture for which it was purchased. Should this particular

prop be used in another picture at a later date, that picture is charged with a fixed rental per day, the rental being credited to overhead.

Daily Production Costs: Some studios place all costs on a daily basis, that is, all time slips are computed daily, overhead distributed on a daily rate and all costs incurred in one day are accumulated under the day in which the order was placed.

All reports showing work done on the pictures are forwarded to the accounting department and all data is accumulated under the various sub-accounts on a daily cost sheet. This sheet usually shows the budget or estimated cost of the picture and the actual accumulated cost to date. Copies of this cost sheet are distributed to the executives of the studio as well as the production manager.

Statistics

Rates of Depreciation:

Buildings: Stages, 8 to 10%.

Other Buildings: stucco or frame, 6 to 10%; concrete—Class A, 3 to 5%; concrete—Class B, 6 to 8%.

Equipment: cameras, 15 to 25%; electrical, 15 to 25%; laboratory, 20%; machinery and tools, 20 to 50%; props, 25 to 33 1/3%; sound, 20 to 50%; wardrobe, 50 to 66 2/3%; draperies, 50 to 66 2/3%; projection, 15 to 20%; stock sets, 50 to 66 2/3%; automobiles and trucks, 20 to 25%; furniture and fixtures, 10%.

MINE ACCOUNTING

By Jesse L. Maury

IT IS proposed to discuss in this paper accounting from the viewpoint of the mine manager who, while he will never be called on to design or operate a set of mine accounts, has a very real interest in knowing why and how it is being done.

In order to illustrate the different problems arising in mine accounting the example of a small mine, similar to many western properties, will be considered. It is assumed that the property comprises a mine and a mill. Three hundred tons of ore per day are mined and milled. Two concentrates are made, each of which is sold to a separate smelter. The ore is won from a vein system carrying widths of ore up to 10 feet. The mine is served by a shaft, ore is transported from the mine to the mill by an aerial tramway, and concentrates are loaded direct from the mill to railroad cars. Sixty-five-foot rill stopes are used for mining the larger ore-bodies, while for the smaller blocks flat-back stopes with chutes on 30-foot centers are employed. Electricity is purchased from a power line not belonging to the mining company. Water is supplied from a dam owned by the company. The mill and mine buildings are heated by a central plant. Royalties are paid on the treatment processes used in the mill. Service shops are: warehouse, blacksmith, machine, assay, and carpenter shops.

The staff is as follows: manager, mine foreman, mill superintendent, mining engineer and helper, bookkeeper, two timekeepers who assist the bookkeeper, assayer, mechanic, blacksmith, carpenter, electrician, warehouse clerk, three mill-bosses, and ten shift-bosses.

The general accounts are carried at the main offices of the company, while subsidiary books are kept at the mine. It is with these subsidiary books that this paper is concerned. It is assumed that depletion and depreciation are carried on them, although this is frequently not the case, these accounts often being handled at the main office. Once a month a profit and loss statement is calculated and the mine books are closed to the home office.

We have here the ordinary business situation: a group of

assets, ore, development workings, and various equipment, which have a presumptive earning power when the equipment is set to work at bringing the ore to a marketable state. The earning power will depend upon the margin between the sales price of the ore and the total of all costs of bringing it to market. What is the value of the business at any time? What changes are taking place in the assets? What are the costs of production? What are the earnings? These are some of the questions that accounting attempts to answer.

In reaching an answer to these questions, accounting makes the assumption that all the physical elements of a business can be given accurate money values, obviously an assumption which is not true, but the application of which will yield the data upon which to make informed guesses as to the state of the business. If the fact that this is merely a necessary assumption be kept in mind, many of the controversial points in accounting theory will resolve themselves into the argument of conservative versus optimistic practice.

Accounting bases all its calculations upon the continuing balance of the fundamental equation, expressed in terms of money:

Assets — Liabilities = Net Worth

in which Assets are those things owned by the business which have an actual value, Liabilities are those obligations owed by the business to outsiders, and Net Worth is the amount owed by the business to its proprietors.

Changes in Net Worth are brought about in four ways: investment of capital by the proprietors, withdrawal of capital by the proprietors, gains due to operation of the business, and losess due to operation of the business.* It is with the last two changes that the mine management will be chiefly concerned. Additions and withdrawals of capital, except in minor matters, will generally be handled through, or in cooperation with, the home office.

THE BALANCE SHEET

The opening balance sheet of the mine at the time when de-

* Capital gains, that is, gains due to appreciation of assets, and capital losses are not discussed, since they have no application in operating matters.

velopment has ceased to be its main operation and production has begun in earnest (the "basic valuation date") is shown below:

ASSETS

Current Assets			
Cash		$ 50	
Accounts Receivable		1,150	
Concentrates A in Transit		8,000	
Concentrates B in Transit		4,000	
Total Current Assets			$ 13,200
Working Assets			
Supplies Inventories		$ 39,300	
Ore Reserves (152,000 tons @ $4.50)			
Timber on Operating Lands	$ 30,000		
Less—Reserve for Timber Depletion	5,000		
		25,000	
Total Working Assets			748,300
Permanent Assets			
Buildings	$250,000		
Less—Reserve for Depreciation	15,600	234,400	
Machinery and Equipment	$225,000		
Less—Reserve for Depreciation	11,800	213,200	
Total Permanent Assets			447,600
Total Assets			$1,209,100

LIABILITIES

Current Liabilities		
Audited Vouchers	$ 920	
Payroll Accrued	22,000	
Taxes Accrued	4,300	
Total Current Liabilities		$ 27,220
Home Office Account		$1,181,880
Total Liabilities		$1,209,100

During the coming year, many changes will take place in the balance sheet. The current assets will increase or decrease, supplies on hand will fluctuate, a certain amount of the ore reserves will be extracted at a cost and sold at a price, new ore will be developed, buildings and equipment will depreciate, and so forth. The management will be called on to report frequently

as to the state of the assets and liabilities and the amounts of earnings. It will also be actively interested in the details of the costs of operation, particularly those which are directly under its control and are subject to change according to the quality of its work.

Home Office Account

The discussion of this account will be aided if the mine management be considered as a separate unit from the home office. The latter represents the proprietary interest from which comes the original investment in the property and to which go the profits of the operation. The management, on the other hand, has been presented with the property and charged with the preservation of the assets and the responsibility for their operation. At the end of any given period, the management may relieve its responsibility for that period by reporting the results of its operations and closing the books to those of the home office.

The Home Office Account opens with a credit balance into which have gone all the funds advanced from the home office to bring the plant to production (less revenue obtained during the development period). In the future it will be credited with all funds advanced from the home office and debited with all funds sent from the mine. Its balance will thus represent at all times the proprietary interest in the property.

It will be noted that the general group of profit and loss accounts, those having to do with changes in net worth, do not appear on the balance sheet. These accounts are cancelled out as a total profit or loss for a given period and the resulting figure applied to the Home Office Account as a credit or debit respectively, thus clearing the mine books for the new period.

Cash

The small cash item shown is known as Petty Cash. It is usually handled as a fund of constant amount, brought up to the stated amount periodically by a check drawn upon the home office. The Home Office Account is credited with the refunding amount and debits are made to the proper expense accounts from the cash book.

Other payments for supplies, labor, and so forth are made by check. Sight drafts are drawn upon the home office, payable either there or at some local bank, credits to the Home Office Account and debits to the proper expense accounts being made at the time. For payrolls, a check for the total amount against the home office may be deposited with a local bank and individual checks drawn against the balance thus established.

Accounts Receivable

This account represents small transactions with local interests; sales of powder and tools to leasers, rentals due, or similar items. Receivables from smelters do not figure here, since smelter payments will generally be made through the home office and entered upon the local books upon advice from the home office as a debit to Home Office Account and a credit to the smelter accounts in the profit and loss section.

Concentrates in Transit

The Concentrates in Transit accounts are set up in order that at the end of any accounting period those concentrates which have been shipped to the smelters but for which no settlement sheets have been received may be carried as assets in the balance sheet. Like all other assets, they should be carried at cost, but due to the difficulty of determining their true cost continuously, it will be advisable to carry them at a nominal cost approximating their true cost. Also, in order to avoid discrepancies between mill and smelter weighings, it is recommended that they be carried in terms of railroad cars rather than tons. When a car of concentrate is shipped, Concentrates in Transit is debited for that car at a nominal cost, a corresponding credit being made to Sales of Concentrate in the profit and loss section. When the settlement sheet and notice of payment for that car is received from the home office, Concentrates in Transit is credited for that car at nominal cost, and Sales of Concentrate is credited with the difference between the nominal cost and the net smelter returns. The balance will be cleared at the end of the period to Profit and Loss.

The above applies to concentrates which are not sold under

contract. If a regular contract is in force with the smelter, nothing is gained by carrying the concentrates at cost. They may, instead, be carried at the usual price received from the smelter, based on current metal prices, and upon receipt of payment the adjustments can be carried out exactly as before.

Supplies Inventories

Supplies Inventories is debited with all incoming supplies according to the invoice price, a corresponding credit being made to Audited Vouchers. The latter represents the obligations not yet met by sight drafts on the home office.

On large items for which it is an easy matter to determine the freight charges, these should be added to the invoice price of the item. On smaller articles, it is well to charge freight to a general expense account. Supplies Inventories is credited with goods issued for use in operation, corresponding debits being made to the proper accounts by analysis of requisition slips. No supplies should be issued without a requisition and all supplies should be issued at the cost price, or cost plus freight.

Perpetual inventories are kept of all classes of goods, the sum total of these sub-inventories being the Supplies Inventories Account. A perpetual inventory is a record which shows at all times the amount and value of a certain stock of goods. It is maintained by the use of a card for that stock of goods on which is entered each incoming lot of those particular goods at cost price, and each issue of those goods at cost price. At the time of each entry, a balance is reckoned showing the stock on hand.

When different prices are paid for different lots of the same goods, it becomes necessary to decide at what price these goods shall be issued. It is recommended that the "Oldest Cost First" method be used, whereby all goods issued will be given the cost of the oldest lot on hand. When that lot is closed out, the cost of the next lot is taken as the cost at which goods are issued.

At the end of each year, a count of stores on hand is made, and if a discrepancy between the book value and actual value is found, the accounts are adjusted to bring them into accord with the facts.

Ore Reserves

Considerable attention has been given to the matter of perpetual

inventories because of its bearing on the maintenance of the Ore Reserves Account. The treatment of this account is a moot question among mining men, and for a good reason. The ore reserves of a mine are undoubtedly one of its working assets and should be treated as such from the standpoint of theoretical accounting. The inconsistency lies, however, in the fact that their quantity is unknown in most cases. From this clash between the theory of accounting and the geological difficulties of estimating ore in place, come the various systems for accounting for depletion. Several of these systems will be discussed, but the individual mine operator must decide upon one of them according to the requirements of his case.

1. Perpetual Inventory Method

The simplest system from an accounting viewpoint considers the Ore Reserves Account as a perpetual inventory. The account receives its original debit at the basic valuation date, comprising all costs of bringing the mine to a producing stage (less credits for revenue during development), except those otherwise recoverable by depletion or depreciation. In it are included development costs, organization costs and the purchase price of operating lands (less timber on operating lands, the cost of which is recoverable through depletion). A corresponding credit is made to the Home Office Account.

Subsequent debits to this account will represent the cost of development of new ore. It will probably not be found convenient to furnish a figure for estimated tons of ore developed more than once a year, at which time an average cost of all ore developed during the year may be reckoned and this tonnage entered in the inventory at cost price.

In order to avoid the discrepancies arising from abandonment of small blocks, excessive estimates, or deficient estimates, the amount entered as developed tonnage for the period should be calculated by beginning with the total inventory at the end of the period and working back to a figure for developed ore with the figures for extraction and inventories at the beginning of the period.

Credits to this account are made from the actual figure for

tons of ore mined, as compiled by weighing machines in the mill, charged out at the oldest cost first. A corresponding debit is made to Depletion Account in the profit and loss section.

Skeleton accounts illustrating the entries under this system are shown below:

Dr. Ore Reserves Cr		Dr. Home Office Cr.	
Original cost of ore reserves at basic valuation date	Ore extracted at cost		Original cost of ore reserves at basic valuation date
Costs of development of new ore			Costs of development of new ore

Dr. Depletion Cost Dr	
Ore extracted at cost	Cleared to Profit and Loss

It will be noticed that the Home Office Account is credited with the development costs of one period, representing an advance of funds to the mine management. In a subsequent period, when this ore is mined, no money is actually spent for depletion, although the cost of each unit of ore is charged into the cost of mining. There will, then, be an excess of funds transmitted to the home office, representing the depletion charges paid for in the previous period and now being charged out in the process of extraction. This excess is accounted for when the Depletion Cost account is cleared through Profit and Loss to the Home Office Account.

The major criticism of this system is that the amount of the ore reserves is not known although their total cost is. The unit cost to be charged into costs of mining, which is calculated by dividing total cost by estimated number of units, may be found to be seriously in error, due to mistaken estimates, changes in metal prices, abandonment of small blocks, etc. The situation is, however, only slightly different from that of an industrial concern faced with the necessity for re-valuation of its inventories due to changes in the prices of commodities.

2. Reserves for Depletion Method

A second system, representing merely a variation of the first, employs the device of setting up reserves for depletion.

The Ore Reserves Account is split into two accounts, the debit side retaining the title of Ore Reserves, the credit side being named Reserve (or Allowance) for Depletion. The algebraic

sum of the two will then be the cost of the ore reserves remaining. The Reserve for Depletion is usually shown on the balance sheet as a deduction from Ore Reserves.

The two skeleton accounts under this system are shown below:

Dr. Ore Reserves	Cr.	Reserve for Depletion Cr.
Original cost of ore reserves at basic valuation date		Ore extracted at cost
—		
Cost of development of new ore		

Home Office Account and Depletion Cost will be treated as under the perpetual inventory system.

This system is probably preferable to any other when it can be used. It shows at all times the total amount spent for ore reserves, the total amount charged out as a depletion cost, and the net cost of the ore reserves remaining and calls attention to the fact that funds are being advanced for development and being expended subsequently in extraction.

3. Development as a Cost of Mining

When it is a hopeless matter to determine the tonnage of ore developed, the "plums in a pudding" situation, it becomes logical to treat development as a cost of mining. In this case, a certain amount of development must be carried on in order to keep stoping areas in sufficient number and extent for normal operations, but no estimate can be obtained of the number of units of ore developed. Two systems may be employed:

(a) In the first case, it is assumed that no estimate of the probable cost of maintaining stoping areas can be made. Development is carried on at an undetermined rate in the hope that ore will be found. The skeleton accounts are shown below:

Dr. Ore Reserves	Cr.	Dr. Home Office	Cr.
Original cost of undetermined amount of ore			Original cost of Undetermined amount of ore
			—
			Cost of Development

Dr. Development Cost	Cr.
Cost of development	Cleared to Profit and Loss as a cost of mining

The credit to Home Office Account for the costs of development arises when payment is made at the mine by draft on the home office for all the elements entering into the costs of development. The original cost of the beginning ore reserves will remain as a credit to the Home Office Account. When it becomes apparent that no further ore remains to be extracted, this amount will be taken as a loss.

(b) If some estimate can be made for the development cost necessary for the maintenance of stoping areas sufficient to insure normal operations, this amount may be set up as a standard rate per ton of ore mined. The skeleton accounts are shown below:

Dr. Ore Reserves	Cr.
Original cost of undetermined amount of ore	

Dr. Excess of actual cost of development over standard	Cr.

Dr. Home Office	Cr.
Original cost of undetermined amount of ore	
—	
Cost of development (actual)	
—	
Excess of standard cost of development over actual	

Dr. Cost of Development	Cr.
Standard cost of development	

If the actual cost of development per ton of ore mined during a certain period exceeds the estimate, the loss is taken up in the Home Office Account by a debit equal to the excess. If the estimated standard cost exceeds the actual expenditure, the gain is shown by a credit for the difference to the Home Office Account. Revised estimates should be made at the beginning of each period, based on past experience, in order that the estimated rate may be as close as possible to the actual.

The last system described is frequently the one most satisfactory to mining men, even where close geological control is maintained and accurate estimates of ore reserves are possible. The attitude taken is that the original ore reserves of a mine constitute the major asset in its capital account. The charge necessary for maintenance of that asset at its original dimensions is a necessary part of the cost of doing business. Thus, if a ton of ore be developed for each ton of ore extracted, the cost of that

development may logically be charged to the cost of extraction. The device of a standard estimated cost is used to insure comparability of figures through the accounting period.*

Timber on Operating Lands

This account receives its original debit from an estimate made of the value of timber on operating lands at the time when the purchase price of operating lands is closed to Ore Reserves. The Reserve for Timber Depletion Account is credited with all timber felled on these lands at an estimated unit value, a corresponding debit being made to Depletion of Timber Account in the profit and loss section. The balance of the two accounts, Timber and Reserve for Timber Depletion when operations cease, will represent the residual value of the timber.

Buildings

This account receives its original debit from the purchase price or construction cost of all buildings at the basic valuation date, a corresponding credit being given to the Home Office Account. It is debited and credited subsequently when buildings are bought or sold.

Reserve for Depreciation of Buildings

Depreciation costs are based on the fact that assets lose their value with use and the passage of time. For a business the working assets of which are inexhaustible, the rate of depreciation may be calculated on the life of the asset under consideration. For a mine, however, unless the life of the asset is less than the life of the mine, the depreciation rate must be based on the life of the mine, an estimate at best. The rate may be reckoned on a basis of elapsed time or tonnage extracted. Considering the nature of the business, the latter seems preferable.

Similarly to the treatment of ore reserves, a reserve account for depreciation is set up. The account is credited with depreciation charges by a pre-determined schedule showing the charges for each building for each accounting period, corresponding debits

* The author's intention has been to discuss only the accounting treatment of depletion viewed from an operating standpoint. For discussions of the Federal Income Tax regulations and the proposed changes to a percentage of net income basis, see various current publications.

being distributed to the different accounts having depreciation as a component of their costs, if desired. The usual practice, however, is to have a separate account for depreciation expense which is not cleared to other accounts but is held as a separate cost.

When a building is sold, Buildings is credited with the full cost price of the building. Reserve for Depreciation of Buildings is debited, the amount written off as depreciation to the date of sale, Cash is debited with the sales price, and the difference between the depreciated valuation and sales price is debited or credited to Profit and Loss according to whether a loss or a profit has been the result of the transaction.

Machinery and Equipment

Machinery and Equipment Account and its reserve account are handled in exactly the same way as the buildings accounts.

Accounts Payable

Audited Vouchers receives its credits from all vouchers which have been examined by those in authority and passed on as payable. Corresponding debits are made to all accounts affected by the purchases, including Supplies Inventories, Buildings, Machinery, Equipment, and so forth.

Payroll Accrued

Payroll Accrued receives its credits from the payroll summary prepared for each period, corresponding debits being made to each account affected. It is debited when the payroll is paid.

There will be pay checks uncalled for occasionally. A set time should be established when such checks shall be cancelled, and since checks to laborers can generally be cashed by anyone, this matter should be carefully controlled. When the checks are cancelled, a check for the total amount is drawn to the home office and forwarded with an appropriate explanation. Home Office Account is debited and Unclaimed Wages is credited. This credit balance may be cleared to Profit and Loss occasionally when it becomes apparent that certain wages will never be claimed.

Taxes Accrued

Taxes Accrued is credited monthly with one-twelfth of the estimated yearly State and Local Taxes. Corresponding debits

are made to Local and State Taxes Accounts in the profit and loss section. Federal taxes are handled through the home office and will not appear in the mine books.

THE PROFIT AND LOSS STATEMENT

The Profit and Loss Statement is essentially a report of the results of the operation of the business for a certain period of time. In it are included the figures for revenue from sales of product and the expenses incurred in bringing the product to market. The latter are shown as a deduction from the former, the result being the profit or loss for the period. Such a statement for a year's operation is shown below:

INCOME		
Sales of Concentrates		
Concentrate A, 18,000 tons @ $ 75	$1,350,000	
Concentrate B, 9,000 tons @ 100	900,000	
Total Sales of Concentrates		$2,250,000
Concentrates in Transit at Nominal Cost		
Concentrate A, 8 cars @ $1,000	8,000	
Concentrate B, 4 cars @ 1,000	4,000	
Total Concentrates in Transit		12,000
Miscellaneous Income		3,500
Total Income		$2,265,500
EXPENSE		
Operating Expense		
Mining Ore, 108,000 tons @ $6.55	707,400	
Milling Ore, 108,000 tons @ 1.50	162,000	
Total Operating Expense		869,400
Operating Profit		$1,396,100
Deferred Charges		
Ore Depletion, 108,000 tons @ $4.50	486,000	
Timber Depletion	5,400	
Depreciation, 108,000 tons @ 40¢	43,200	
Total Deferred Charges		534,600
Profit After Deferred Charges		$861,500
Miscellaneous Expense		1,160
Net Profit		$ 860,340

To such a summarized statement there will generally be ap-

pended a series of supporting schedules showing the details of revenue and expense in itemized form. Cost accounting is the art of compiling these itemized expense reports so that they shall clearly reflect the costs of the separate operations necessary to bring the ore to market, and it is by a study of these costs that management may make use of accounting in improving the efficiency of operation.

The perfect system for determining these costs and bringing each one into the proper focus does not exist, for the requirements of the individual case must always be considered. The system discussed below is intentionally generalized, so that an excess of detail will not cloud the main principles.

In general we may distinguish between the direct and indirect costs of any operation. The cost of stoping, for example, includes the direct and easily measurable cost of labor at the face, but in addition there is a certain portion of the cost of superintendence which is no less a part of the cost of the stoping operation, but which is not measurable and can only be estimated in the most logical manner available, and distribution made on a pre-determined and equitable basis. This process of distribution is applied to many accounts and may easily be carried too far. A few accountants consider it necessary to "load all expenses on the point of the tool", a practice which is often necessary in the highly competitive, consumer goods markets, but in mining this practice will tend to obscure the accounts in which management is most interested, the controllable components of any operation, by combining with them a number of uncontrollable and arbitrarily determined, distributed costs.

A generalized list of accounts in the Net Worth (Profit and Loss) Section is given below:

EXPENSES TO BE DISTRIBUTED

Section 1. INDIVIDUAL DISTRIBUTIONS

- Local Taxes
- Operating Lands
- Buildings
- Employer's Liability
- Electricity Purchased
- Heating Plant
- Blacksmith Shop

Machine Shop
Assay Shop
Carpenter Shop

Section 2. General Expense

Supervision
Clerical
Warehouse
Freight Incoming
Freight on Concentrates
State Taxes
Lighting, Line-Losses, and Small Power
Minor Repairs and Replacements to General Equipment
Miscellaneous General Expense
Distributed Expenses
General Expense Distributing Account

Section 3. General Mine Expense

Mine Supervision
General Mine Labor
Compressed Air
Hoisting
Haulage
Pumping
Stations
Repair and Maintenance of Workings
Minor Repairs and Replacements of General Mine Equipment
Miscellaneous General Mine Expense
Distributed Expense
General Mine Expense Distributing Account

Section 4. General Mill Expense

Supervision
General Labor
General Materials
Water
Ore Tramming
Royalties
Minor Repairs and Replacements to General Mill Equipment
Miscellaneous General Mill Expense
Distributed Expense
General Mill Expense Distributing Account

Operations Accounts

Mining Ore
Rill Stopes
Drilling
Direct Labor

Direct Materials
Blasting
Direct Labor
Direct Materials
Mucking
Direct Labor
Direct Materials
Timbering
Direct Labor
Direct Materials
Piping
Direct Labor
Direct Materials
Distributed Expense
Flat Back Stopes
Sub-accounts as under Rill Stopes
Drifts in Ore
Sub-accounts as under Rill Stopes
Raises in Ore
Sub-accounts as under Rill Stopes

MINING ORE CLEARING ACCOUNT
Developing Ore
Sinking
Sub-accounts as under Rill Stopes
Station-cutting
Sub-accounts as under Rill Stopes
Pockets
Sub-accounts as under Rill Stopes
Crosscutting
Sub-accounts as under Rill Stopes
Drifts in Barren Veins
Sub-accounts as under Rill Stopes
Raises in Barren Veins
Sub-accounts as under Rill Stopes

DEVELOPING ORE CLEARING ACCOUNT
Milling Ore
Crushing
Direct Labor
Direct Materials
Direct Power
Distributed Expense
Grinding
Sub-accounts as under Crushing
Conveying

Sub-accounts as under Crushing
Classifying
Sub-accounts as under Crushing
Tabling
Sub-accounts as under Crushing
Flotation
Sub-accounts as under Crushing
Filtration
Sub-accounts as under Crushing
Concentrates Disposal
Sub-accounts as under Crushing
MILLING ORE CLEARING ACCOUNT

PROFIT AND LOSS ALLOCATION ACCOUNT
INCOME
Sales Concentrate A
Sales Concentrate B
Miscellaneous Income
OPERATING COSTS
Mining Ore
Milling Ore
DEFERRED CHARGES
Ore Depletion
Timber Depletion
Depreciation
MISCELLANEOUS EXPENSE

Section 1. Individual Distributions

Section 1 includes a number of expenses which will be distributed individually at the end of any period to the proper accounts below. The method of distributing a single account is shown in Figure 1, the journal for distribution of Electricity Purchased. Electricity Purchased Account is debited with the power company's bill, a corresponding credit being made to Audited Vouchers. The account is then credited with an equal amount, closing it to the distribution journal, through which it is debited to the proper accounts.

Two factors enter into the power charge; the horsepower charge, known also as the peak-load charge, readiness to serve charge, and so on, and the charge for actual kilowatt-hours used.

The horsepower charge is distributed according to the horsepower rating of the different units of operation. The horsepower rating of the general expense item, Lighting, Line-Losses, and

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Account	Hp. Rating	% Total Hp.	Kw-H Used	% Total Kw-H	Date Hp. Charge	Kw-H Charge	Total Charge
Electricity Purchased ..			355,000		$2,500	$3,550	$6,050
Milling Ore	900	50.5	270,000	76.0	1,260	2,700	3,960
Ore Haulage to Mill..	100	5.6	5,000	1.4	140	50	190
Hoisting	200	11.2	25,000	7.0	280	250	530
Compressed Air	300	16.8	30,000	8.5	420	300	720
General Mine Expense..	200	11.2	20,000	5.7	280	200	480
General Expense, Lighting, Line-Losses and Small Power	80	4.7	5,000	1.4	120	50	170
	1.780	100.0		100.0	2,500	3,550	6,050

FIGURE 1

Small Power, can be estimated closely enough for satisfactory results.

The kilowatt-hour charge is distributed according to metered amounts of power used. Meters are placed before the following units: mill, tramway, hoist, compressor, and mine collar. The difference between the total of the readings of these five meters and the kilowatt hours charged gives the figure for Lighting, Line-Losses and Small Power. The charge for General Mine Expense from the meter at the mine collar includes power charges for pumping, hauling, and so forth. If it is desired to separate these charges, the different units of power used underground must be metered. Similarily with the detailed uses of power in the mill.

Other individual distributions are treated in much the same way, varying only in the sources of their debits and the bases upon which they are distributed. Local Taxes, being a tax upon improvements is best distributed to the General Expense, General Mine Expense, and General Mill Expense divisions on the basis of the valuations of improvements employed by the different units. Operating Lands Accounts receives its debits from the expense connected with the lands, surveying, fencing, and so on, and may be distributed upon the basis of a real use. Buildings is debited for small repairs, watchmen, and so forth, and should be apportioned according to the cubic feet used by the different departments. Employer's Liability expense is distributed according

to the payroll summary. Heating Plant is distributed on the basis of the ratio of the squares of the diameters of the heat lines. Blacksmith Shop is distributed to General Mine Expense and General Mill Expense according to the number of hours each unit is serviced. Similarly with Machine Shop and Carpenter Shop. Assay Shop may be apportioned according to the number of assay determinations made for mine and mill.

Section 2. General Expense

This section includes a number of accounts which may be conveniently grouped together and distributed as one amount. The sources of debits to these accounts are fairly evident.

Minor Repairs and Replacements includes only those "incidental repairs which neither materially add to the value of the property nor appreciably prolong its life, but keep it in an ordinarily efficient operating condition."* The asset accounts are not debited with these expenditures, but they are charged directly to the cost of operations. Major replacements may be conveniently charged to the Reserve for Depreciation, in order to avoid the continuous necessity for clerical work in the capitalization of new assets.

It is to be noted that a great deal of flexibility is allowable between sections 1 and 2. If greater detail and accuracy are required, many of the headings under General Expense may be classed as individual accounts and distributed as such. If the amounts distributed under some of the individual accounts are found to be small enough that their distribution makes no appreciable difference in final costs, they may be put under the head of General Expense and distributed as a total sum.

All accounts in the General Expense section are closed to the General Expense Distributing Account, from which they are distributed to General Mine Expense and General Mill Expense. The basis decided upon for this distribution will probably be an arbitrary one, expressed in percentage. Man hours cannot be considered equitable, due to the discrepancy between labor employed in mine and mill for the results obtained and general expense required. The relative power consumed by the two units has been

* Regulations 74 of the United States Treasury Department, Income Tax Act of 1928, Article 124, Page 36.

suggested at times as a basis, but this does not appear particularly sound. A division of 60% to mine and 40% to mill is not uncommon, but this should be modified without hesitation according to the judgment of those concerned.

Section 3. General Mine Expense

General Mine Expense has now received debits from all the individual distributions and from the general expense distributing account, these all appearing in the Distributed Expense account. The sources of debits for some of the other listed accounts require discussion.

Supervision receives the charges for mine superintendent, mining engineer and helper and the shift-bosses.

General Labor includes such charges as watchmen, yard clean-up, nippers, powder-monkeys, pipe-men, ventilation, and so forth.

All general mine expense accounts are closed into the General Mine Expense Distributing Account, through which they are closed to Distributed Expense Accounts under the different classifications for Mining Ore and Developing Ore. These charges may be distributed either on the basis of man-hours worked in the different working places or on the basis of cubic feet of excavation in each for the period. Since most of the charges to be distributed are more nearly functions of excavation than of labor, the writer prefers the cubic-foot basis. On this basis, working places in which labor is much less effective than in other, for example, drifts as compared with stopes, do not receive the added burden of excessive charges due to excess man-hours.

For operations such as postulated in this article, the engineering department will have no difficulty reckoning the cubic feet of excavation from actual measurements. For systems of mining which render measurement of stopes impracticable, an approximation can be obtained from car-tallies.

Section 4. General Mill Expense

This division has received debits from the individual distributions and the general expense distribution, appearing in the Distributed Expense Account. The sources of debits to the other listed accounts require no explanation.

All the accounts in the division may be closed to General Mill

Expense Distributing Expense, from which they may be distributed to the unit operations. The value of this is doubtful and in most cases it will be found desirable merely to close this account direct to Milling Ore Clearing Account.

Operations Accounts

In this section we have those accounts which deal with the basic operations of production, milling, mining and developing ore. How these operations will be analyzed for control purposes will depend largely upon the operating conditions and the desires of the management. The outline shown divides the underground operations first, according to the object of the working, mining or development, second, according to the nature of the working place, and third, according to the constituent operations in the process of excavation. The first division is necessary in order that development charges may be segregated from mining charges for purposes of capitalization of ore reserves. The second will yield comparative costs for different shapes of excavations, and the third will indicate where and how money is being spent in the excavation process. It is in these accounts that the management will find its best tool for control of costs.

Mining Ore

Each of the classifications of working places will receive its debit from general mine expense distributed in the Distributed Expense Account. Under the unit operations, Direct Labor and Direct Materials will be charged according to requisition slips, powder tallies, time books and the like.

Drifts and raises in ore should be defined from drifts and raises in barren veins.

It is recommended that a drift be said to be in ore when it has entered sufficiently into ore that in the judgment of the management is of commercial width and grade that the first chute in a flat-back stope may be installed; that is, one-half of the distance between chutes, or 15 feet.

It is recommended that a raise be said to be in ore when it has entered sufficiently into ore that in the judgment of the management is of commercial width and grade to establish a sill, the face of which shall be entirely in ore; that is, 7 feet.

All accounts in the Mining Ore division are closed to the Mining Ore Clearing Account, from which they are cleared to Profit and Loss.

Developing Ore

The accounts in this division are handled similarly to those in the Mining Ore Division. They are cleared to Ore Reserves if the inventory method is used, or to Profit and Loss if development is considered a cost of mining.

Milling Ore

These accounts are handled in much the same way as those under Mining and Developing Ore. As mentioned above, it is doubtful whether anything is gained by distributing general expenses to the unit operations of milling. The accounts are closed to Milling Ore Clearing Account and cleared to Profit and Loss.

Profit and Loss Allocation Account

This section includes the income accounts, operating costs, deferred charges and miscellaneous expenses.

Income is posted directly upon receipt of advice from the home office as to smelter receipts. Miscellaneous income will include small amounts, such as royalties from lessors, rentals and so forth.

Operating costs include the cleared accounts from the Mining and Milling Ore divisions.

Deferred charges are posted from the journal records of depletion of ore and timber and from the depreciation schedules.

Miscellaneous expense may comprise such items as under-estimated taxes, losses in inventories, unclaimed wages previously written off and later called for, etc. These minor adjustments are taken up in the final calculations at the year's end.

Profit and Loss is closed to the Home Office Account, and the final balance sheet for the period struck off.

Such a balance sheet appears below:

ASSETS

Current Assets		
Cash	$ 50	
Accounts Receivable	460	
Concentrates A in transit	8,000	
Concentrates B in transit	4,000	
Total Current Assets		$ 12,510

Working Assets			
Supplies Inventories		$ 47,800	
Ore Reserves			
152,000 tons @ $4.50	$684,000		
90,000 tons @ 2.50	225,000		
	909,000		
Less—Reserve for Depletion	486,000		
Net Ore Reserves		423,000	
Timber on Operating Lands	30,000		
Less—Reserve for Depletion	10,400		
Net Timber on Operating Lands		19,600	
Total Working Assets			$490,400
Permanent Assets			
Buildings	$250,000		
Less—Reserve for Depreciation	42,600		
Net Buildings		207,400	
Machinery and Equipment	225,000		
Less—Reserve for Depreciation	28,000		
Net Machinery and Equipment		197,000	
Total Permanent Assets			404,400
Total Assets			$907,310

LIABILITIES

Current Liabilities		
Audited Vouchers	$ 1,400	
Payroll Accrued	18,400	
Taxes Accrued	19,460	
Total Current Liabilities		39,260
Home Office Account		868,050
Total Liabilities		$907,310

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